a) feeding a vapor-phase pulse of a rare earth metal source chemical into the reaction space, said metal source chemical being a cyclopentadienyl compound of the rare earth metal;

b) contacting the vapor-phase pulse of the rare earth metal source chemical with the surface of the substrate;

c) purging the reaction space with the aid of an inert gas;

d) feeding a vapor-phase pulse of an oxygen source chemical into the reaction space;

e) purging the reaction space with the aid of an inert gas; and

f) repeating steps a) through e) to deposit a rare earth metal oxide thin film of a desired thickness.

16. (New) The process of Claim 15, wherein the oxygen source chemical is selected from the group consisting of water, hydrogen peroxide, a mixture of water and hydrogen peroxide, a mixture of oxygen and ozone, and oxygen plasma products.

17. (New) The process of Claim 15, wherein the rare earth metal source chemical is fed into the reaction space with the aid of an inert carrier gas.

18. (New) The process of Claim 15, wherein the oxygen source chemical is fed into the reaction space with the aid of an inert carrier gas.

19. (New) The process of Claim 15, wherein the substrate is selected from the group consisting of a silicon wafer and soda lime glass.

20. (New) The process of Claim 15, wherein the substrate is a compound semiconductor.

21. (New) The process of Claim 20, wherein the substrate is GaAs.

22. (New) An atomic layer deposition (ALD) process for depositing a rare earth oxide thin film on a substrate in a reaction space comprising:

feeding a vapor-phase pulse of a metal source chemical into the reaction space ;

removing unreacted vapor-phase metal source chemical from the reaction space;

feeding a vapor-phase pulse of an oxygen source chemical into the reaction space; and

removing unreacted vapor-phase oxygen source chemical from the reaction space,

wherein the metal source chemical is selected from the group consisting of tris(cyclopentadienyl)yttrium (Cp_3Y), tris(methylcyclopentadienyl)yttrium ($(CpMe)_3Y$) and tris(methylcyclopentadienyl)lanthanum ($(CpMe)_3La$).

23. (New) The process of Claim 22, wherein the oxygen source chemical is selected from the group consisting of water and a mixture of oxygen and ozone.

24. (New) The process of Claim 23, wherein the metal source chemical is $(CpMe)_3Y$.

25. (New) The process of Claim 24, wherein the temperature in the reaction space is between about 175°C and about 450°C and the pressure in the reaction chamber is between about 1 mbar and about 50 mbar.

26. (New) The process of Claim 25, wherein the temperature in the reaction space is between about 200°C and about 400°C.

27. (New) The process of Claim 25, wherein the pressure in the reaction chamber is between about 1 mbar and about 2 mbar.

28. (New) The process of Claim 23, wherein the metal source chemical is Cp_3Y.

29. (New) The process of Claim 28, wherein the temperature in the reaction chamber is between about 175°C and about 400°C, and the pressure in the reaction chamber is between about 1 mbar and about 50 mbar.

30. (New) The process of Claim 29, wherein the temperature in the reaction chamber is between about 250°C and about 300°C.

31. (New) The process of Claim 29, wherein the pressure in the reaction chamber is between about 1 mbar and about 2 mbar.

32. (New) The process of Claim 23, wherein the metal source chemical is tris(methylcyclopentadienyl)lanthanum ($(CpMe)_3La$).

33. (New) The process of Claim 32, wherein the temperature in the reaction chamber is from about 160°C to about 165°C and the pressure in the reaction chamber is between about 1 mbar and about 50 mbar.

34. (New) The process of Claim 33, wherein the pressure in the reaction chamber is between about 1 mbar and about 2 mbar .

35. (New) The process of Claim 22, wherein the substrate is selected from the group consisting of a silicon wafer and soda lime glass.